US009384308B2

(12) **United States Patent**
Snyder et al.

(10) **Patent No.: US 9,384,308 B2**
(45) **Date of Patent: *Jul. 5, 2016**

(54) **MULTI-DIMENSIONAL ARTIFACT ASSEMBLAGE FOR INFRASTRUCTURE AND OTHER ASSETS WITH INTERFACE NODE MEDIATORS**

(75) Inventors: **Rob Snyder**, Lexington, KY (US); **John Frampton**, Glenmoore, PA (US); **Sunand Sandurkar**, Pune (IN); **Raymond B. Bentley**, Elverson, PA (US)

(73) Assignee: **Bentley Systems, Inc.**, Exton, PA (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 889 days.

This patent is subject to a terminal disclaimer.

(21) Appl. No.: **12/652,411**

(22) Filed: **Jan. 5, 2010**

(65) **Prior Publication Data**

US 2011/0166831 A1 Jul. 7, 2011
US 2011/0301919 A2 Dec. 8, 2011

(51) **Int. Cl.**

G06F 17/50	(2006.01)
G06T 19/00	(2011.01)
G06F 3/0482	(2013.01)
G06F 3/0488	(2013.01)

(52) **U.S. Cl.**

CPC ***G06F 17/5004*** (2013.01); ***G06F 3/0482*** (2013.01); ***G06F 3/0488*** (2013.01); ***G06T 19/00*** (2013.01); *G06T 2219/004* (2013.01)

(58) **Field of Classification Search**

CPC . G06F 17/5004; G06F 3/0488; G06F 3/0482; G06T 19/00; G06T 2219/004
USPC 703/1; 345/620, 621
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

5,815,154	A	9/1998	Hirschtick et al.	
5,982,378	A *	11/1999	Kato	345/582
6,115,025	A *	9/2000	Buxton et al.	345/659
7,010,472	B1 *	3/2006	Vasey-Glandon et al.	703/6

(Continued)

FOREIGN PATENT DOCUMENTS

WO WO-2007/084647 A2 7/2007

OTHER PUBLICATIONS

Kalbacher et al., Development and application of a CAD interface for fractured rock, 2005, Environmental Geology 47, pp. 1017-1027.*

(Continued)

Primary Examiner — Kamini S Shah
Assistant Examiner — Juan Ochoa
(74) *Attorney, Agent, or Firm* — Cesari and McKenna, LLP; James A. Blanchette

(57) **ABSTRACT**

A system and method to compile different types of data from different locations into one reliable assemblage is provided. The assemblage includes an index of information provided to a user. The assemblage may be in the form of a three dimensional (3D) representation of an object, where the 3D representation includes an index and links to more detailed information regarding the object. The 3D representation of any object, for example, a body part in the context of medical imaging, or a building in the context of architectural and engineering design. The assemblage is comprised of 3D and 2D artifacts. The 2D artifact includes 2D vector and raster embellishment in a variety of forms. The 3D artifact includes vector graphics (2D and 3D) including all data obtained through data conversion methods, and "Point clouds" (voxels).

24 Claims, 7 Drawing Sheets